Disparities in Influenza Vaccination Coverage Rates by Target Group in Five European Countries: Trends Over Seven Consecutive Seasons

Blank, P R ; Schwenkglenks, M ; Szucs, T D

Abstract: BACKGROUND: The primary objective of this study was to measure influenza vaccination coverage rates in the general population, including children, and in high-risk groups of five European countries during the season 2007/2008. An additional aim was to analyze coverage trends over seven consecutive seasons and to gain an understanding of the primary drivers and barriers to immunization. METHODS: Community-based telephone and mail surveys have been conducted in the UK, Germany, Italy, France, and Spain, yearly, since 2001/2002. Approximately 2,000 individuals per country and season were interviewed who were considered to be representative of the adult population aged 14 years and older. Data on the vaccination status of children were obtained by proxy interviews. The questionnaire used was essentially the same for all seven seasons. Five target groups were identified for the study: (1) persons aged >/= 65 years; (2) elderly suffering from a chronic illness; (3) patients suffering from a chronic illness; (4) persons working in the health care sector; (5) children. RESULTS: In the season 2007/2008, vaccination coverage rates in the general population remained stable in Germany. Compared to the coverage rates of the previous season, increases of 3.7%, 2.0%, and 1.8% were observed for the UK, Spain, and France, respectively, while a decrease of -1.5% was observed for Italy. Across all five countries, vaccination rates in the predefined target groups decreased to some extent (elderly) or increased slightly (chronically ill and health care workers). Vaccination rates among children varied strongly between countries and ranged from 6.1% in UK to 19.3% in Germany. The most powerful motivation for getting vaccinated in all countries was advice from a family doctor (58.6%) and the perception of influenza as a serious illness (51.9%). The major reasons why individuals did not become vaccinated were (1) the feeling of not being likely to catch influenza (39.5%) and (2) never having considered the option of being vaccinated (35.8%). CONCLUSIONS: The change in general influenza vaccination coverage in the 2007/2008 season compared to the previous season was small, but decreases were seen in some target groups. The underlying motivations for and against vaccination did not substantially change. An effort to activate those driving forces that would encourage vaccination as well as dealing with barriers that tend to prevent it may help enhance coverage rates in Europe in the future.

DOI: https://doi.org/10.1007/s15010-009-8467-y

Blank, P R; Schwenkglenks, M; Szucs, T D (2009). Disparities in Influenza Vaccination Coverage Rates by Target Group in Five European Countries: Trends Over Seven Consecutive Seasons. Infection, 37(5):390-400.
DOI: https://doi.org/10.1007/s15010-009-8467-y

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Results: In the season 2007/2008, vaccination coverage rates in the general population remained stable in Germany. Compared to the coverage rates of the previous season, increases of 3.7%, 2.0%, and 1.8% were observed for the UK, Spain, and France, respectively, while a decrease of −1.5% was observed for Italy. Across all five countries, vaccination rates in the predefined target groups decreased to some extent (elderly) or increased slightly (chronically ill and health care workers). Vaccination rates among children varied strongly between countries and ranged from 6.1% in UK to 19.3% in Germany. The most powerful motivation for getting vaccinated in all countries was advice from a family doctor (58.6%) and the perception of influenza as a serious illness (51.9%). The major reasons why individuals did not become vaccinated were (1) the feeling of not being likely to catch influenza (39.5%) and (2) never having considered the option of being vaccinated (35.8%).

Conclusions: The change in general influenza vaccination coverage in the 2007/2008 season compared to the previous season was small, but decreases were seen in some target groups. The underlying motivations for and against vaccination did not substantially change. An effort to activate those driving forces that would encourage vaccination as well as dealing with barriers that tend to prevent it may help enhance coverage rates in Europe in the future.

Infection 2009; 37: 390–400
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Introduction

The main objective of infectious disease surveillance according to the European Centre for Disease Prevention and Control (ECDC) is to reduce the incidence and prevalence of communicable diseases [1]. The significance of routine monitoring is especially pertinent in the case of influenza vaccination. Influenza epidemics occur nearly every winter and account for considerable mortality and morbidity with three to five million cases of severe illness and between 250,000 and 500,000 deaths every year worldwide [2]. The highest rates of serious illness or death occur among the elderly over 65 years of age and among chronically ill patients [2, 3].

The most appropriate action for the prevention and reduction of the burden of influenza epidemics is vaccination [2]. Influenza vaccine is a trivalent vaccine and needs to be updated annually. The effectiveness of inactivated influenza virus vaccine has been confirmed in several studies among all age groups [4–6]. Furthermore, vaccination has been shown to be both cost-efficient and cost-saving [7–9]. Children experience high attack rates that may reach 40% of the general pediatric population during annual influenza epidemics [10]. Consequently, the vaccination of children not only implies protection for

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Received: December 10, 2008 · Revision accepted: March 26, 2009
Published online: September 18, 2009

each child but also avoids absenteeism of parents caring for their sick children and provides additional benefits due to the effects of herd immunity [11, 12].

Recommendations at the European level are that persons over 65 years of age and individuals with underlying chronic illnesses should receive influenza vaccination. Since continuing efforts are required to tie in national regulations of the Member States with the improvements and developments induced by the Program of Community Action in the field of public health (2003–2008), the European Parliament has established a second program of Community Action on Health (2008–2013) [13, 14]. National regulations vary in some Member States from the recommendations of these programs. Current government vaccination policies in the UK, Germany, Italy, France and Spain are based on age, with vaccination generally being recommended for individuals 65 years of age and older (except in Germany, where the age cut-off is set at 60 years), and the presence of chronic medical conditions, such as chronic pulmonary diseases (asthma included), cardiovascular diseases (except hypertension), renal diseases, hepatic diseases (except Italy and France), hematological or metabolic disorders (such as diabetes mellitus), immunological disorders, including HIV/AIDS (in France, the doctor who is in charge of the HIV patient has to indicate the advice for vaccination), and pregnancy (in Italy and Spain) [15–19]. The vaccination of health care workers is also recommended. Hence, the meaning of a high influenza coverage rate in the general population and especially in the at-risk groups is underlined and supported by several stakeholders.

Current pediatric guidelines do not recommend vaccination in healthy children, whereas children aged ≥ 6 months with diabetes, cardiac or renal diseases, an immune-compromised or HIV-positive status (except Italy). or receiving chronic aspirin therapy (except Germany and UK) should receive the vaccine [20].

This cross-sectional study focuses on current vaccination coverage rates and related trends in five European countries during seven consecutive influenza seasons. The emphasis is not only on vaccination status in high-risk groups and children but also on an inter-country comparison of drivers for and barriers against vaccination, and vaccination intentions for the following season 2008/2009.

Methods

Study Design

A population-based cross-sectional survey was carried out in the 2007/2008 influenza season in the UK, Germany, Italy, France, and Spain. During seven consecutive influenza seasons, from 2001/2002 to 2007/2008, representative household surveys were conducted using the same methodology. The fieldwork methodology has been described earlier [21]. In brief, telephone interviews were conducted by TNS healthcare using a computer-assisted telephone interviewing system (CATI) in all countries except France. French data were collected via a postal questionnaire compiled and administered by GEIG (Groupe d'Etude et d'Information sur la Grippe). Adults with children replied for each child (up to five children per interviewee). To obtain a representative sample of the national non-institutionalized adult population, interviews were carried out according to quotas, and a weighting was applied with respect to gender, age, profession, geographic region, and town size. Quotas and weighting factors were based on data from official national sources [22].

Subjects

The survey populations were representative of the adult population aged 14 years or older in Germany, Italy and Spain, 15 years or older in France, and 16 years or older in the UK. In Spain, individuals over 75 years of age were not included in the survey. The surveys were carried out in December and January. As in the previous seasons, approximately 2,000 interviews were conducted per country (UK: 2007, Germany: 2002, Italy: 2000, Spain: 2000). In France, 4,576 persons responded to the questionnaire. In order to adjust the sample size with that of the other countries, the French data were weighted according to standard criteria to represent 2,000 individuals instead of 4,576.

At the beginning of each telephone call, the agreement and explicit verbal consent of the interviewees was obtained. There was no study intervention, and the anonymity of the participants was guaranteed. According to the Esomar World Research Codes and Guidelines, this type of study is considered market research and does not require the approval of an ethics committee, as this survey is a study of people who are deemed healthy and not, therefore, in the medical system [23].

Cross-Sectional Survey

The survey questions have been published earlier [22]. Across all countries, the questionnaire remained basically the same during the complete study period. Data from Spain have been available since 2002/2003.

In 2007/2008, the questionnaire covered vaccination uptake as well as reasons for and against vaccination. Information on chronic illnesses was collected from 2003/2004 onwards. In order to identify chronically ill persons, examples were provided to the respondents (heart or lung disease, diabetes or others), and the type of the disease has been reported beginning in 2007/2008. The vaccination status of children was recorded in all countries except France beginning in 2005/2006. The upper age limits of the children differed between countries (13 years in Germany, Italy and Spain; 14 years in France; 15 years in the UK). In addition to the vaccination status, data collection covered the age of the children and the number of children per family. Questions regarding avian influenza were added in the 2005/2006 season, and the current questionnaire contains questions on the concerns of respondents for experiencing side effects from the vaccine and if traveling to known high-risk regions (in terms of influenza) would encourage them to get vaccinated.

Statistical Analysis

Based on the above-described recommendations [15–19], we defined four at-risk groups for the 2003/2004 to 2007/2008 influenza seasons as follows: (1) individuals aged 65 years or older; (2) elderly suffering from a chronic illness; (3) other individuals suffering from a chronic illness; (4) individuals working in the medical field (health care workers). Persons belonging to none of the four above-defined target groups were classified as members of the non-target group. Children were treated separately.

The annual datasets were pooled (for analysis across all five countries), and sample weights were applied to correct for small deviations from the age and gender quotas required. SPSS® version 14 for Windows (SPSS, Chicago, IL) was used for the statistical evaluation. To avoid double counting – for example, those over 65 years who also have a chronic illness or those health care professionals who suffer from a chronic illness – we analyzed the vaccination coverage rates in at-risk groups vs the non-target group (including individuals less than 65 years of age without a chronic illness and not working in the health care sector).

Bivariate associations of categorical variables were assessed with the χ^2 test, and the χ^2 test for trend was used for evaluating time trends of these variables. For all statistical tests, two-sided $p \leq 0.05$ was used as the level of statistical significance. Ninety-five percent confidence intervals (CI) are reported as appropriate. Due to the descriptive nature of this data, no corrections for multiple testing were made.

Covariates identified as potential predictors of influenza vaccination in univariate analysis were considered as candidates for multivariable analysis. Logistic regression was used to identify the independent explanatory value of correlates of the outcome of interest, i.e. vaccination coverage. The following variables were regarded as potential predictors of vaccination coverage: gender, age, chronic illness, working in the medical field, educational level, and household income. All covariates were included in the initial models for the 2007/2008 data from each country. Non-significant predictors ($p > 0.05$) were subsequently removed on a stepwise basis. However, covariates that were significant for any country were retained in all models in order to facilitate comparison.

The data for the children are presented separately due to the different data acquisition process on the basis of proxy respondents.

Results

Vaccination and Intention Rates in the General Population

Characteristics of the survey participants are summarized in table 1. The response rate, including valid interviews, refusals, interviews beyond the quotas, and appointments, across all countries was 58% (UK 33%, Germany 54%, Italy 72%, Spain 55%, France 76%). Among all of those approached using the telephone, 15% completed the telephone interview (UK 4%, Germany 7%, Italy 22%, Spain 28%).

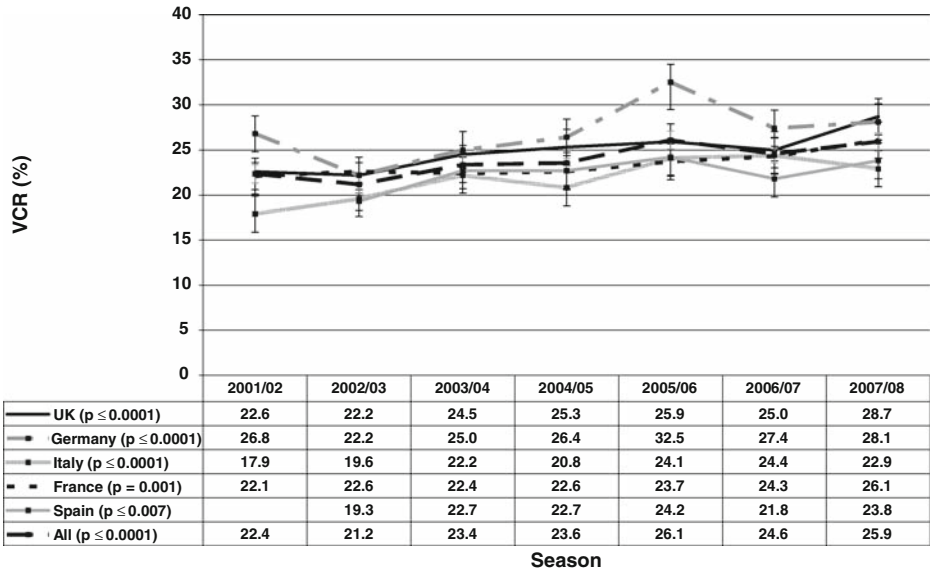
Figure 1 shows vaccination coverage rates for the current season 2007/2008 and trends over the last seven seasons. In the 2007/2008 season, coverage rates in the general population ranged from 22.9% in Italy to 28.7% in the UK. Compared to the previous season of 2006/2007, a statistically significant increase was only seen in the UK ($p = 0.008$). However, a long-term positive development of the coverage rates was confirmed for all countries (Figure 1). A transitory peak in the 2005/2006 season can be attributed to fear of the avian influenza, which received high media attention at the time.

By grouping the sample in eight different age classes, we confirmed an ascending curve shape with advancing age. In the UK and Spain, the highest coverage was found in the 70- to 74-year-old population (87.0%, 95%CI 81.0–93.0%; 72.8%, 65.8–79.8%, respectively). In the other countries, the coverage was highest in the group aged 75 years and older, reaching 70.7% (95%CI 63.7–77.7%) in Germany, 72.2% (95%CI 66.2–78.2%) in France, and

Table 1
Overview of adult sample in season 2007/2008.

Variables	UK	Germany	Italy	France	Spain	All
Sample size	2,007	2,002	2,000	2,000	2,000	10,009
Mean age (years)	45.4	48.1	45.5	46.6	42.2	45.6
95% CI	44.6–46.2	47.3–48.9	44.7–46.2	45.8–47.5	41.5–43.0	45.2–45.9
Male	48.5%	48.0%	48.7%	48.3%	49.6%	48.6%
95% CI	46.4–50.7%	45.8–50.2%	46.4–50.8%	46.0–50.5%	47.4–51.8%	50.4–52.4%
Age ≥ 65 years	19.6%	24.7%	17.4%	20.1%	12.3%	18.8%
95% CI	18.6–21.6%	22.7–26.7%	16.4–19.4%	18.1–21.1%	11.3–14.3%	17.8–19.3%
Work in the medical field	8.5%	8.5%	3.8%	6.3%	6.7%	6.8%
95% CI	7.3–9.8%	7.3–9.7%	2.9–4.6%	5.2–7.4%	5.6–7.8%	6.3–7.3%
Chronic illness	15.3%	24.9%	10.6%	16.3%	14.4%	16.3%
95% CI	13.7–16.9%	23.0–26.8%	9.3–12.0%	15.0–18.4%	12.9–16.0%	15.–17.1%
Respondents with at least one child	22.4%	17.5%	24.4%	NA	21.9%	
Children (n)	823	546	750		646	2765
Households by number of children						
0	77.6%	82.5%	75.6%	NA	78.1%	82.7%
1	8.6%	9.7%	13.5%	NA	12.6%	8.9%
2	9.9%	6.1%	9.3%	NA	8.3%	6.7%
3	3.1%	1.3%	1.4%	NA	0.8%	1.3%
4	0.6%	0.3%	0.2%	NA	0.1%	0.2%
5+	0.2%	0.1%	0.1%	NA	NA	0.1%

NA: Data not available



	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
UK (p ≤ 0.0001)	22.6	22.2	24.5	25.3	25.9	25.0	28.7
Germany (p ≤ 0.0001)	26.8	22.2	25.0	26.4	32.5	27.4	28.1
Italy (p ≤ 0.0001)	17.9	19.6	22.2	20.8	24.1	24.4	22.9
France (p = 0.001)	22.1	22.6	22.4	22.6	23.7	24.3	26.1
Spain (p ≤ 0.007)		19.3	22.7	22.7	24.2	21.8	23.8
All (p ≤ 0.0001)	22.4	21.2	23.4	23.6	26.1	24.6	25.9

Error bars: 95% confidence intervals
p-values: trend over time

Figure 1. Vaccination coverage rates (VCR) in the general population during seven influenza seasons. Error bars: 95% confidence interval; p-value: trend over time.

72.4% (95%CI 64.4–81.4%) in Italy. The lowest coverage was seen in the population aged below 39 years in all five countries.

Vaccination Rates in At-Risk Groups

Age

Trends in vaccination coverage rates in the elderly (over 65 years of age) without chronic illnesses are given in figure 2a. In the current season of 2007/2008, enhanced vaccination uptake compared to the year before was found in the UK and France, even though this increase could not be statistically confirmed ($p = 0.226$ and $p = 0.716$, respectively).

Chronic Illness

The distribution of chronic illnesses (regardless of age) is presented in table 2 for all of the countries except France, for which these data were not available. A high proportion of these patients declared themselves as suffering from cardiovascular disease, and this subgroup seemed to be more likely to get vaccinated (average of countries: odds ratio [OR] 1.8, 95%CI 1.4–2.3, $p \leq 0.0001$). Diabetes patients had an OR of 2.2 (95%CI 1.7–2.9, $p \leq 0.0001$) compared to non-diabetes patients.

Figure 2c presents the vaccine coverage among chronic illness patients below the age of 65 years. The highest coverage was found in UK (56.7% 95%CI 49.7%–63.7%), despite a non-significant decrease compared to 2006/2007 ($p = 0.523$). France was the only country with a statistically significant positive trend across time ($p = 0.024$). The reverse was true for Germany where a negative trend was identified ($p = 0.025$) and a minimum of 26.5% (95%CI 21.5%, 32.5%) was reached in season 2007/2008.

Elderly with Chronic Illness

Our data show a rising proportion of chronic illnesses with advancing age. Across all countries we found that 8.8% (95%CI 8.1–9.5%) of the individuals under the age of 50 suffered from chronic illnesses, whereas in those aged 65 years or older, the proportion was 33.3% (95%CI 31.2–35.5%). The vaccine uptake was particularly high in the combined at-risk group (Figure 2b). Statistically significant results across time were found in Germany ($p \leq 0.0001$) (Figure 2b).

Health Care Workers

During the interviews, respondents working in the health care sector were asked to disclose their profession (Table 2). Within this target group, the highest influenza vaccine uptake, 34.2%, was found among nursing professionals (across all countries, 95%CI 12.2–56.2%). Employees from the medical or the paramedical field had average rates of 26.5% or 19.4%, respectively.

The vaccination uptake by health care workers is shown in figure 2d. In general, the uptake among these at-risk persons was low, and there is no evidence of a positive development over time. The best vaccinated group was found in Spain (25.4%, 95%CI 18.4–23.4%). Vaccination coverage was poor in Italy – 10.9% (95%CI 2.9–18.9%) – where a negative time trend was noted (p-value across seasons: 0.034).

Non-target Group

In 2007/2008, the coverage of the non-target group ranged from 10.6% (95%CI 8.6%–11.6%) in the UK to 14.5% (95%CI 11.5%–16.5%) in Germany (Figure 2e). Compared to the previous season, only marginal changes were noted.

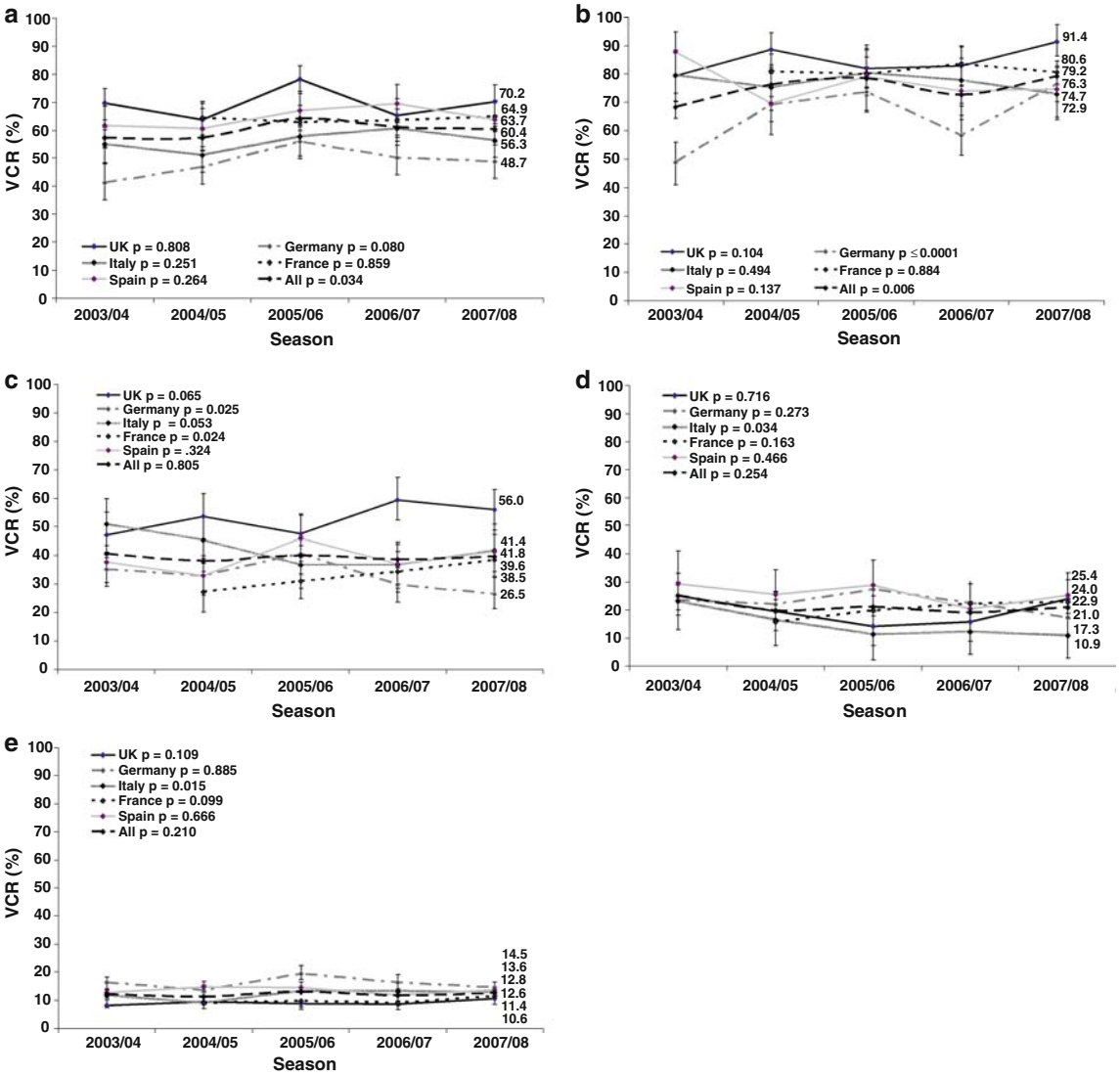


Figure 2. Vaccination coverage rates (VCR) in at-risk populations during five influenza seasons. **a** VCR rates in the elderly, **b** VCR in the elderly chronic ill patients, **c** VCR in chronically ill patients, **d** VCR of health care workers, **e** VCR of non-target group members. Error bars: 95% confidence interval; p-value: trend over time.

Odds Ratios of At-Risk Groups for Getting Vaccinated

In the final multivariate logistic regression models, the following covariates were taken into account as potential predictors of getting vaccinated: target group membership (age, chronic illness, working as health care worker), higher educational level, and higher household income. Gender was not found to be a significant predictor and hence was not taken into account. For the UK, no information on education was available, and in data on income and education level were not available for France. The resulting adjusted ORs of vaccination are shown in table 3.

As shown in table 3, being elderly and suffering from a chronic medical condition were powerful predictors for getting vaccinated in all five countries. As expected, persons with both characteristics combined showed even higher ORs. On the other hand, being employed in the health care sector was a statistically significant explanatory variable in the UK, France, and Spain only. German and Italian medical employees did not seem to be more likely to get vaccinated. These two countries also had the lowest actual coverage rates in 2007/2008 (Figure 2d).

A higher income (≥ 2,500€ per month) did not seem to be a factor which positively influenced the decision to get

Table 2
At-risk group population according to medical condition/profession (2007/2008).

Persons with chronic disease	UK	Germany	Italy	Spain	All
n	307	498	212	289	1,306
Type of disease (%)					
Respiratory	49.7	31	24.1	37.7	35.6
Cardiovascular	23.6	37.1	33	16	27.4
Diabetes	32.9	22.5	19.2	17.7	23.1
Transplantations	1	0.1	0.4	0.4	0.5
Long-term cancer survivals	3.7	4.7	2.3	2.8	3.4
Others	19.1	22.7	23.5	28.4	23.4

Health care field (2007/08)	UK	Germany	Italy	France	Spain	All
n	171	170	75	58	133	607
Health care workers (%)						
Nursing	39.3	36.9	16.2	37.9	28.6	31.8
Paramedical[a]	13.3	16.1	28.4	41.4	30.8	26.0
Medical	22.0	22.0	28.4	5.2	12.8	18.1
Non-clinical/medical[b]	4.6	13.7	17.6	NA	18.0	13.5
Others	9.2	NA	6.8	6.9	NA	7.6

[a] Pharmacist, physiotherapist, masseuse; [b]Administrative, assistant, receptionist, pharmaceutical company
NA: Data not available

Table 3
Adjusted odds ratios of vaccination coverage in target groups in the 2007/2008 season (adjustment for age ≥ 65 years, chronic illness, working in the medical field, income and education).

Variable	UK	Germany	Italy	France	Spain
n[a]	2,004[a]	1,991[a]	1,257	4,415[a]	1,994[a]
Age[b]	19.1	5.3	7.1	14.3	7.5
95% CI	13.8–26.4	4.0–7.2	5.0–10.2	10.5–19.6	4.6–12.2
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
Chronic illness[b]	10.7	2.1	4.5	4.9	4.0
95% CI	7.5–15.1	1.5–2.9	2.8–7.3	3.5–6.9	2.7–6.1
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
Chronic illness and age[b]	85.9	17.9	12.8	31.7	15.7
95% CI	43.7–169.0	12.5–25.7	7.1–22.8	19.7–51.0	7.9–31.4
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
Work in medical field[b]	2.7	1.2	0.9	2.3	2.0
95% CI	1.8–4.1	0.8–2.0	0.3–2.6	1.4–3.8	1.1–3.6
p-value	<0.001	0.389	0.835	0.001	0.032
Income per month (< 2499€[c]/> 2500€)	0.9	0.7	0.7	NA	0.6
95% CI	0.7–1.1	0.6–1.0	0.3–1.6	–	0.4–0.9
p-value	0.243	0.021	0.379	–	0.022
Education (low or no education[c]/higher education)	NA	0.9	0.6	NA	1.4
95% CI	–	0.6–1.4	0.5–0.9	–	1.0–2.1
p-value	–	0.705	0.004	–	0.082

[a] n < total sample size for this season due to missing covariate values; [b] reference category is non-target group (persons who do not belong to any target group); [c] Reference category
NA: Not available

vaccinated. In Germany and Spain, the ORs of 0.7 and 0.6, respectively, were statistically confirmed (p-values = 0.021 and 0.022, respectively). Hence, individuals with a higher income appear to get less vaccinated in these countries.

Individuals with a higher educational level (superior studies, university degree, high school, technical college) were also less prone to get vaccinated than those with a lower education. This was especially true for Italy (OR 0.6, p = 0.004), whereas the reverse was true for Spanish graduates, which were more likely to receive the vaccine (OR 1.4, p = 0.082).

Vaccination Coverage Rates in Children

In our study, the vaccination coverage rates among the interviewee's children were assessed during three seasons. The results are presented in figure 3. French data were

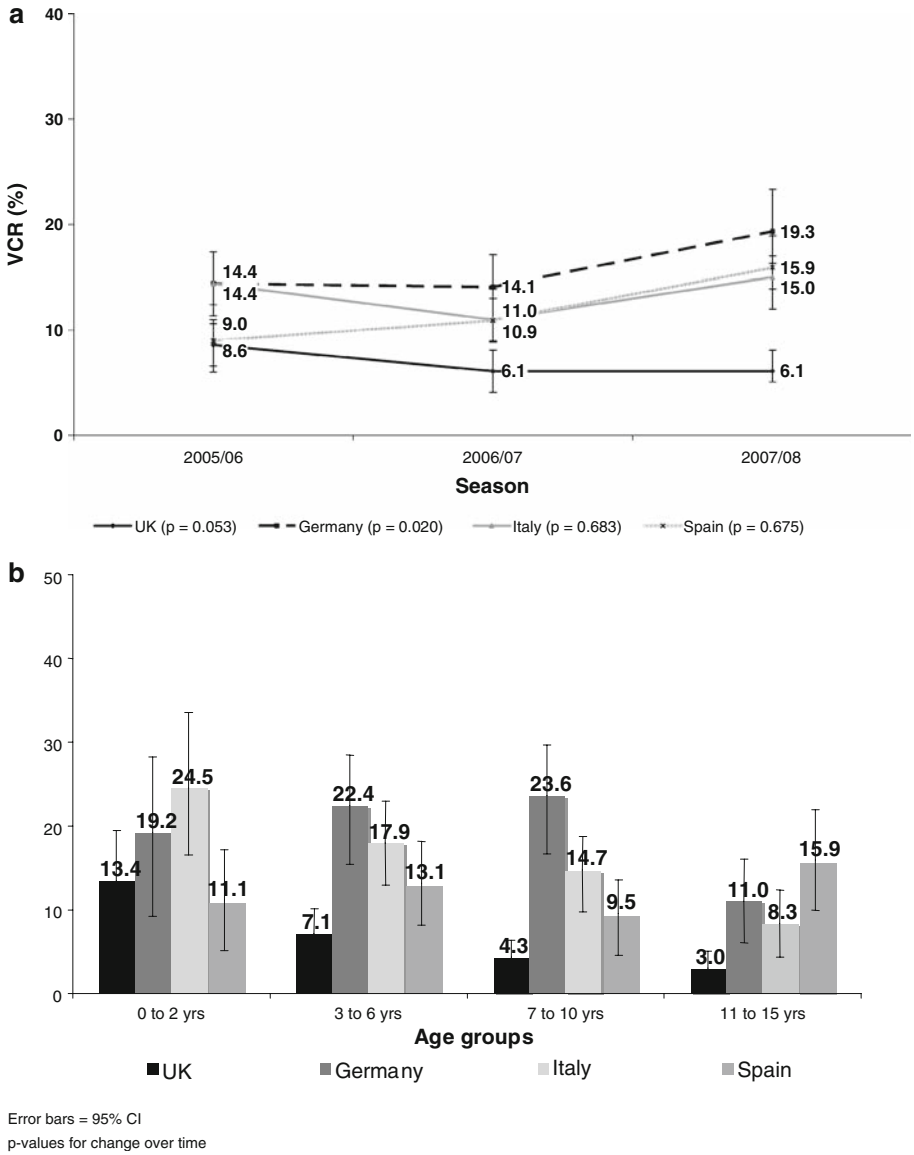


Figure 3. Vaccination coverage among children (2005/2006–2007/2008). **a** Vaccination coverage rates (VCR) in children by country (0–15 years), **b** VCR among children by age groups (season 2007/2008). Error bars: 95% confidence interval; p-value: change over time.

not available. Table 1 shows the total size of the pediatric sample and household according to number of children.

In 2007/2008, parents in all countries with the exception of the UK, vaccinated their children more frequently than in the previous season (2006/2007). In Germany and Italy, the coverage differed significantly from that observed in the previous season ($p = 0.016$ and $p = 0.032$, respectively) (Figure 3a). This was particularly evident for Italian and British children 0–2 years of age (Italian: 24.5%, 95%CI 16.5–33.5%; British: 13.4%, 95%CI 7.4–19.4%). In Germany, children aged 7–10 years old had the highest vaccination rate (23.6%, 95%CI 16.6–29.6%), and in Spain, children aged 11–15 years showed the highest influenza vaccination level (15.9%, 95%CI 9.9–21.9%). Figure 3b shows the vaccination status of children according to age group for the 2007/2008 season.

Parents who belonged to one or more at-risk groups (older age, chronic illness, health care worker) were not more likely to vaccinate their children. This trend was especially evident in Germany there was a strong negative association between target group membership of the adult respondent and vaccination rate in the children from these households (OR 0.5, 95%CI 0.3–0.9, $p = 0.019$ compared to children in the households of non-target group respondents).

Reasons for and Against Vaccination

The principal barriers against and the strongest driving forces for vaccination have been extensively reported in earlier publications [22, 24–26]. In 2007/2008, the ranking of the statements given by both vaccinated and non-vaccinated individuals did not greatly differ from that of previous seasons (Table 4).

Table 4
Reasons for and against vaccination in the general population (season 2007/2008).

Vaccinated population	UK	Germany	Italy	France	Spain	All
n	576	562	458	521	475	2,592
Motivations for getting vaccinated[a] (%)						
My family doctor/nurse advised me to do it	81.9	76.4	49.1	31.8	53.7	1 (58.6%)
Because the flu is a serious illness and I did not want to get it	83.5	88.7	17.7	35.1	34.3	2 (51.9%)
Because of my age	60.0	47.7	15.2	34.3	36.6	3 (38.8%)
So I do not pass the flu bug to my family/friends	61.9	73.9	14.6	18.8	24.2	4 (38.7%)
Because the social security system pays for it	51.5	42.4	4.8	44.3	17.7	5 (32.1%)
Because I am not in good health	37.5	31.9	19.1	13.9	27.5	6 (26.0%)
To prevent me from interrupting my professional activity	36.7	25.4	13.3	12.5	18.6	7 (21.3%)
Non-vaccinated population	**UK**	**Germany**	**Italy**	**France**	**Spain**	**All**
n	1,152	910	1,375	1,231	1,276	5,944
Reasons for not getting vaccinated[a] (%)						
I do not think I am very likely to catch the flu	45.5	46.7	23.8	15.4	66.1	1 (39.5%)
I have never considered it before	51.3	32.3	32.4	20.4	42.4	2 (35.8%)
My family doctor has never recommended it to me	59.6	32.0	13.9	19.0	38.9	3 (32.7%)
I am too young to be vaccinated	44.6	8.7	18.5	35.0	13.3	4 (24.0%)
It is not a serious enough illness	37.4	37.7	13.0	9.3	8.9	5 (21.3%)

[a] Reasons for getting or not getting vaccinated are given as a percentage and are ranked (column "All") in order of perceived importance by respondents

In addition to the advice from a family doctor (58.6% across all country) and the perception of influenza being a serious illness (51.9%), environmental and lifestyle factors may influence the decision for vaccine uptake. For example, traveling to the tropics presents a permanent, modest risk of getting infected [27]. Hence, traveling to high-risk regions in terms of influenza was mentioned by 8.4% of the UK citizens as a reason for vaccination, whereas this did not play a role in the Spanish population (1.2%). More than 17% of the British population was driven by the media attention on avian influenza and influenza pandemics to get vaccinated. This was a 2.5-fold increase in the vaccination rate over the previous season ($p \leq 0.0001$). Concerns regarding possible side effects from the vaccine seemed to be an obstacle for vaccination, especially among Germans (34.5%), whereas only 4.4% of the Spanish population stated this as a reason for not getting vaccinated. To some extent, persons suffering from chronic illnesses or elderly individuals stated other reasons which were mostly related to the respondent's condition.

In the influenza season 2007/2008, the most common reason for not being vaccinated among those persons who had never been vaccinated was the feeling that they were not likely to catch the influenza (across Europe: 38.8%). For patients with chronic illnesses, another strong argument was never having ever considered being vaccinated or the absence of a recommendation from a health professional (across Europe: 30.5% and 29.9%, respectively). Elderly persons expressed concerns about possible side effects of the vaccine (across Europe: 25.1%) and that they forgot to go for the vaccination (across Europe: 23.4%).

Drivers of vaccination were very similar as those found in the previous seasons [26]. Based on a new questionnaire item, a high proportion of respondents would get vaccinated should they travel to regions with a high risk of influenza (range: 15.0% in Italy to 73.8% in Germany).

Discussion and Conclusion

There is no global system of monitoring vaccination coverage in Europe. The UK has a system to observe the coverage of all at-risk groups, while Spain has no such system whatsoever. The Italian, French, and German surveillance systems are strictly limited to a limited number of at-risk groups. The official German, British, and Italian influenza vaccination coverage data are based on surveys, administrative data are used for this purpose in France and Spain [28]. Therefore, cross-country assessments based on a uniform methodological approach, as reported here, are of particular importance. Telephone surveys are known to be a reliable method for monitoring influenza vaccination among the general population. They also have the advantages of being fast (in terms of data collection) and cost efficient and provide data not only on vaccination status but also on the attitude of the population towards vaccination. Hence, the ability to maintain quality control over the entire data collection process makes telephone surveys a valid method to monitor the vaccination status of populations [29].

There are some limitations to our study that need to be addressed. We were not able to confirm self-reported vaccination uptake or chronic condition status. Nevertheless, previous publications have shown that self-reported data have an adequate degree of reliability, supporting out study approach [22, 30, 31]. Our methodological approach was designed to gather a representative population sample despite low response rates. The growing amount of answering machines, voicemail systems, caller IDs, and mobile phones certainly creates a challenge for those carrying out telephone surveys [32]. Individuals with only a mobile telephone were not integrated in our survey, for the primary reason as they are generally not included in telephone surveys. In addition, such individuals are usually more difficult to reach, and the costs of such interviews are much higher. Therefore, selection bias due to non-response cannot totally be excluded.

Across the countries, the size of the at-risk groups differed to some extent. This can be attributed to the fact that the sample in Spain included people up to 75 years of age only, whereas the surveys in all other countries included older individuals. The differences in the proportion of chronically ill patients may stem from local variations in the understanding of the term chronic illness. Although the question asked was the same in all five countries, the threshold of defining oneself as being chronically ill may be subject to cultural influences. The high proportion of chronically ill persons in Germany has been reported in earlier publications, but no clear explanation has ever been provided [26, 33]. It is also possible that the age cut-off of 75 years in the Spanish survey may have impacted on the prevalence of certain chronic illnesses in the Spanish survey population.

In our survey conducted in UK, Germany, France, Italy and Spain, we found that influenza coverage rates in the general population were about the same as that in the year before. Over the entire study period of 7 years, a positive, statistically significant trend was visible in each of the five countries. An improved and efficient reminder system in Europe may help to enhance coverage rates. People need to be reminded before or during the immunization season, i.e., between September and November, that they should make the effort of being vaccinated. A study conducted in the USA by *Jacobson* et al. identified this as a common reason why adults do not receive immunizations [34]. These authors demonstrated that reminder and recall systems were effective in improving influenza immunization rates in children and adults [35].

In the target groups for which vaccination is recommended, the influenza coverage level did not generally improve since the previous season 2006/2007. In the elderly group over 65 years of age, not all countries appear to be on the way to meeting the World Health Organization's (WHO) target of 75% vaccination coverage in 2010/2011 [14], while some countries are now quite close (UK 70.2%). However, similar rates in the other target groups are nowhere near approaching this target. Specifically, the coverage of chronically ill persons continues to be much lower than that which has been achieved among the elderly, despite a positive trend in some countries (Germany and France). Equally important, health care workers do not appear to have a strong inclination to get vaccinated. The coverage level in this group was low and has even seemed to spiral downwards over the past few years in Italy. This fact has been documented by several European studies with comparable results [36, 37].

In the UK, the Health Protection Agency (HPA) on behalf of Department of Health has carried out annual vaccine uptake surveys that gather data on registered patients in all general practices by a web-based reporting system [38]. During the season 2007/2008, HPA revealed similar coverage rates as our survey among the elderly (73.5% vs 70.2%, respectively). The percentage of vaccinated chronically ill patients (below 65 years) was 45.3% in the HPA analysis, which is lower than the 56.0% observed by our survey [39]. It should be noted that we avoided double counting by analyzing all risk-groups separately. As this was not the case in the HPA study for the aged group, a higher vaccination coverage would be expected. On the other hand, the methodological approach is not exactly the same in both surveys. While the HPA sample was collected from the medical records of general practitioners' (GP) patients, our survey covered the entire population that could be reach by landline telephone connections. Hence, the populations participating in these studies may vary in terms of health status as well as in other respects. These differences suggest that the comparability between the two surveys is limited [40].

The data on the vaccination status of children showed a low coverage, ranging from 6.1% (UK) to 19.3% (Germany) in 2007/2008, with positive trends in Germany. There is no national policy in any of the five countries for vaccinating healthy children. In comparison with the elderly target group, the influenza-related mortality rates are low among the pediatric population (0.2–0.8 per 100,000), even though the hospitalization rate is considerable [41]. Nevertheless, the prevention of influenza in children may substantially reduce the risk of transmitting the virus to family members and to the community [12, 42]. Hence, school-based influenza vaccination programs could help to achieve a reduction in absenteeism and extend the protection to unvaccinated individuals [43]. According to the ECDC, the lack of sufficient vaccination coverage data in children makes the development of specific guidelines complex [44]. Consequently, there are no precise ECDC recommendations in place. Nevertheless, there is no evidence against the immunization of children against influenza [45].

Motivations for vaccinations and barriers against it were analyzed for both the general and at-risk populations. Health care workers were identified as playing an important role in reminding and recommending influenza

vaccination to both the general population and the target populations. Our results further imply that there is a lack of broad and effective communication campaigns aimed at educating the public on influenza and influenza vaccines. *Johnson* et al. recently reported similar findings on obstacles to adult immunization, based on interviews with health care providers [34]. Additional explanations reported by these authors included concerns about side effects, vaccine shortage, infrequent patient visits, and the fear of needles, as well the lack of knowledge on this topic among health care professionals [34]. A further survey carried out among GPs and hospital health care workers found that doctors working in hospitals had restricted access to guidelines and other information on vaccination of the elderly. Hence, they were less likely to endorse the vaccination of the elderly than GPs [46]. Such a lack of awareness among groups of medical employees may have a substantial negative impact on vaccination rates, given the key importance of vaccination recommendations from medical professionals.

Higher educational level is usually expected to positively influence vaccination uptake. The underlying assumption is that educated people understand health promotion messages better and that this leads to more health protective behavioral patterns [47]. However, our survey found a negative influence of educational level that we cannot currently explain. In all countries, the national governments fund, partially or fully, the cost of the vaccine and of vaccine administration in the at-risk groups. For the elderly aged 65 years and above, vaccination is free for all recipients [48]. In particular, the French respondents regarded the funding of the vaccine as extremely motivating for getting immunized, not only in the high-risk groups but also in individuals not at risk. State funding may partially explain why higher income, as higher educational level, did not have a positive impact on vaccination coverage.

In light of our results, different approaches should be combined to increase influenza vaccination coverage levels in Europe. Approaches may include well-timed information campaigns on seasonal influenza immunization, with particular attention paid to targeting at-risk groups and health care workers, improvement of vaccine accessibility (both financially and logistically), the education of health care professionals with respect to improving their ability to identify at-risk patients and increasing the frequency at which they advise patients to get vaccinated, and the involvement of health care professionals in vaccination campaigns. Strong efforts have to be undertaken at the national and international levels to realize the challenging vaccination targets of the WHO in 2010/2011. Increasing vaccination coverage is the primary means to diminish the mortality and overall disease burden of influenza. This research project provides some insights in how the goal of containing the massive burden of disease may better be achieved in the future.

Acknowledgments

Funding Source. This study was made possible by an unrestricted, educational grant from the European Vaccine Manufacturers Group of the European Federation of Pharmaceutical Industries and Associations (EFPIA), Brussels, Belgium.

We thank the GEIG (Groupe d'Expertise et d'Information sur la Grippe) for making the data of France available for this analysis.

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